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Research Article

Ritualistic hunts: exploring the motivations and conservation implications in West Bengal, India

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Abstract

Ritualistic hunts are illegal, large, organised cultural events which are a prevalent concern in West Bengal from both an animal welfare and conservation perspective. We carried out a socio-economic survey with 112 individuals in the districts of Jhargram and West Medinipur to better understand the characteristics of these hunts, the species impacted, and the drivers and motivations of the communities that engage in these types of illegal activity. Specifically, we asked which wild animals were most desirable, which were most profitable, what derivatives from hunted animals were used for, and which wild animals were perceived to have increased most in rarity. We found that these events involve both indiscriminate and targeted killing of a wide variety of wildlife, including at least 93 inferred species (seven of which are categorised on the IUCN Red List as threatened (i.e. either Vulnerable, Endangered or Critically Endangered); in 34 the population trend has been categorised as declining, and 25 are listed on Schedule I of India's Wildlife Protection Act). We found that wild meat/food was the most frequently stated personal use of hunted wildlife in addition to belief-based use, traditional medicine, and decorative use. Engagement in the onward commercial sale of wildlife was also reported by more than a third of hunters. However, personal enjoyment was identified by most hunters as their main motivation for taking part in ritualistic hunts. Despite widespread engagement in ritualistic hunting, we found that the majority of hunters also expressed a willingness to engage in legal non-consumptive alternatives if they were made available. As such, we recommend that in addition to effective law enforcement, further research to identify viable non-consumptive alternatives and inform associated human behaviour change initiatives could help deliver a positive transformation for both wildlife and people in West Bengal.

Key words: Animal welfare, illegal wildlife trade, protected species, Shikar Utsav, traditional hunting

Introduction

Hunting is a threat to wildlife across the tropics (Bennett et al. 2002; Milner-Gulland et al. 2003), and over-exploitation (harvesting at a rate that cannot be compensated for by reproduction or growth), together with agriculture, is one of the biggest drivers of biodiversity decline globally (Maxwell et al. 2016; Caro et al. 2022; Challender et al. 2023). Hunting, in various guises, is a feature of most human communities, at least historically (e.g. Alves et al. 2018), and remains a common practice amongst tribal people, and other community groups, in many countries to this day, including among the various tribal groups residing in India (Dutta and Mondal 2020; Selvan et al. 2013). In West Bengal, tribal communities have a longstanding relationship with forest ecosystems and the wildlife and resources they encompass (Bhattacharya et al. 2016). Hunting wild animals remains deeply ingrained in their cultural practices, reflecting their historical dependence and connection with these environments (Sarkar and Modak 2022). Changing socio-economic circumstances, such as the availability of alternative sources of protein, improved job prospects, awareness of declining wildlife abundance, and increased enforcement of wildlife protection laws, has meant that the need for, and interest in, hunting has declined in some communities over recent years, particularly amongst younger people (Dutta and Mondal 2020). However, engagement in organised ritualistic hunts during village festivals persists, reportedly driven by multiple driving factors including traditional and cultural reasons (Aiyadurai et al. 2010; Ghosh et al. 2013; Dutta and Mondal 2020; Sarkar and Modak 2022).

Ritualistic hunts typically involve large numbers of people who engage in group hunting of various wildlife species on certain days of the year, usually coinciding with a day of cultural or religious significance (Ghai 2017; HEAL 2020; Sarkar and Modak 2022). Undertaken by several different tribes[1] across India, different names are used in different places, and by different tribes; for example, in Jharkhand's Dalma Wildlife Sanctuary, ritualistic hunting is known as "Vishu Shikar", "Sendra", or "Jani Shikar" (Ghai 2017). In West Bengal, ritualistic hunts are called "Shikar Utsav" (or "hunting festival") and typically take place between January and June (Ghai 2017; HEAL 2020). Participation is largely limited to men in the community, who reportedly hunt whatever animals they encounter, with traditional weapons. The impact of ritualistic hunts on local forest biodiversity is difficult to determine. However, the number of participants, and the diversity of species targeted raise concerns about the sustainability of the associated offtake, potential risks to vulnerable and threatened species, and the long-term possibility of contributing to "defaunation" (cf. Poulsen et al. 2023) and "empty forests" (Redford 1992). The methods used also raise additional concerns over animal welfare. For example, several hunters simultaneously chase animals with wooden spears, bows and arrows or hit them with bamboo clubs until they are dead (HEAL pers. comm.).

1 Although this study considers the definition of tribe in a legal and conventional manner, it should be noted that some researchers have attributed tribal status to all humans. This includes Desmond Morris in 'The Human Zoo' in 1969 and David R Samson in 'Our Tribal Future,' in 2023. So whilst this article refers to the identities that the respondents provided, and those provided by law, the authors wish to highlight the wider on-going discussion on tribal characteristics surrounding all humans, and to state unequivocally that there is no inference of discrimination by the usage of the word, 'tribe'.

Hunting has been illegal in India since 1972 when the Wildlife (Protection) Act (WPA) was originally enacted. Updated in 2022, the WPA remains a comprehensive piece of legislation, under which hunting of all forms of wildlife in India is prohibited, as is the possession and trade in wild animal derivatives (including trophies) without previous permission in writing from the Chief Wildlife Warden or the Authorized Officer (Legislative Department, Ministry of Law and Justice, Government of India). Although traditional community rights to wildlife and forest resources are granted under Section 3(l) of the Scheduled Tribes & Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 or Forest Rights Act (FRA), the FRA specifically excludes the use of forest animals as a right (i.e., hunting or trapping or extracting a part of the body of any species of wild animal). India has been a signatory to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) since 1976. CITES aims to regulate international legal trade to safeguard certain listed species from overexploitation (www.cites.org). Species, such as tigers and pangolins are currently listed in Appendix I of CITES, and as such, international commercial trade in these animals, their parts, or derivatives is essentially prohibited (Gomez et al. 2023). Despite these legislative deterrents, illicit hunting still continues in parts of India for recreation, subsistence, trade, in retaliation to human-wildlife conflicts, and as part of traditional ceremonies, especially of tribal communities (Aiyadurai et al. 2010; Aiyadurai 2011; Gubbi and Linkie 2012 and references therein; Bhupathy et al. 2013).

In relation to the situation in West Bengal, the continuation of these festivals recently prompted a decision by the Calcutta High Court in early 2023 which equated "indiscriminate wildlife hunting" with murder under Section 302 of the Indian Penal Code (Kaul et al. 2023). Furthermore, it accused the Chief Wildlife Warden of West Bengal of non-compliance with a court directive issued in 2019 to curb hunting festivals in southern West Bengal (Kaul et al. 2023). To address the issue, the Calcutta High Court proposed the creation of "Humane Committees" to ensure the implementation of the 2019 ban and prevent further indiscriminate animal killings for five districts (including Jhargram and West Medinipur) where hunting rituals were prevalent (Kaul et al. 2023). These committees would need to comprise a district judge, district magistrate, police superintendent, representatives from the forest department and railways, civil society representative, and a tribal community representative (Kaul et al. 2023).

Study aims

Despite substantial media coverage in recent years (e.g. Dasgupta 2016; Sarkar 2016; The Statesman 2019; Nibedita 2021), comparatively little academic research has focused on trying to develop a deeper understanding of the drivers and potential impacts of ritualistic hunting in West Bengal (as compared to research carried out elsewhere in parts of Northeast India, see, for example, Aiyadurai et al. 2010; Aiyadurai 2011; Velho et al. 2012). To help address this situation, and to better understand the drivers and motivations of communities in West Bengal that engage in ritualistic hunting, we carried out a socioeconomic study in two neighbouring districts (Jhargram and West Medinipur) where

ritualistic hunting is prevalent. We used in-person questionnaire surveys and asked what species respondents are hunting and why, how often they hunt, and what their captures are used for. Ultimately, our aim was to provide an evidence base upon which local and national level interventions can be designed to help shift communities away from illegal hunting activity and towards sustainable non-consumptive alternatives. This would also reduce the risk of negative impacts on the welfare and conservation status of the species involved.

Methods

Study site

The study was carried out in West Bengal (Fig. 1), the thirteenth largest state in India in terms of area (88,752 km^2) and the fourth most populous state (population density: 1,000 per km^2), located in the eastern region of India (latitude: 27°13'15"N to 21°25'24"N, longitude: 85°48'20"E to 89°53'04"E, wb.gov.in). West Bengal stretches from the Himalayas in the north to the Bay of Bengal in the south and is bounded in the north by Sikkim and Bhutan, in the south by the Bay of Bengal, in the east by Assam and Bangladesh and in the west by Odisha, Bihar and Nepal. Questionnaire surveys were carried out in villages in the districts of Jhargram and West Medinipur (Fig. 1), located between the Chota Nagpur Plateau and the Gangetic Plains in the south of West Bengal. These two districts form the southern part of the former Junglemahal (translated as "jungle estates"; the term has no formal meaning but is still commonly used, Das 2021). Jhargram has an area of 3,042 km^2 and, in the 2011 census, a population of 1.14 million (jhargram.gov.in), whilst West Medinipur has an area of 9,295 km^2 and a population of 5.94 million (paschimmedinipur.gov.in).

In both districts, a large proportion (94% and 88%, respectively) of the population live in rural areas in relatively small, closely spaced villages (average distance between neighbouring villages = 1.17 km, Pal 2019). The landscape is primarily agricultural land interspersed with patches of tropical dry, deciduous forest, a large proportion of which is classified by the Forest Department as Reserved (c. 59% across West Bengal as a whole) or Protected Forests (c. 32%), where felling/burning trees and clearing land is prohibited (Indian Forest Act, 1927, nbaindia.org). In Jhargram there has been significant forest regeneration since the 1980s, with almost 7,000 km^2 of new forest land area generated between 1985 and 2015 (Mandal and Chatterjee 2021). In Jhargram (as of 2011) 29.4% of the population was tribal (the highest proportion of tribal people in West Bengal, Bera and Roy 2022, jhargram.gov.in), and in West Medinipur 14.9% of the population was tribal (paschimmedinipur.gov.in).

Data collection

The questionnaire survey was conducted in August and September 2022 by local field staff who asked a set of 26 predetermined questions (Suppl. material 1) that included open-ended, closed, and multiple-choice questions. The questionnaire focused on hunter demographics, the drivers and socio-economic dynamics of ritualistic hunting, the attitudes of participants towards ritualistic hunting, the species involved, and perceived impacts of the hunt on the forest

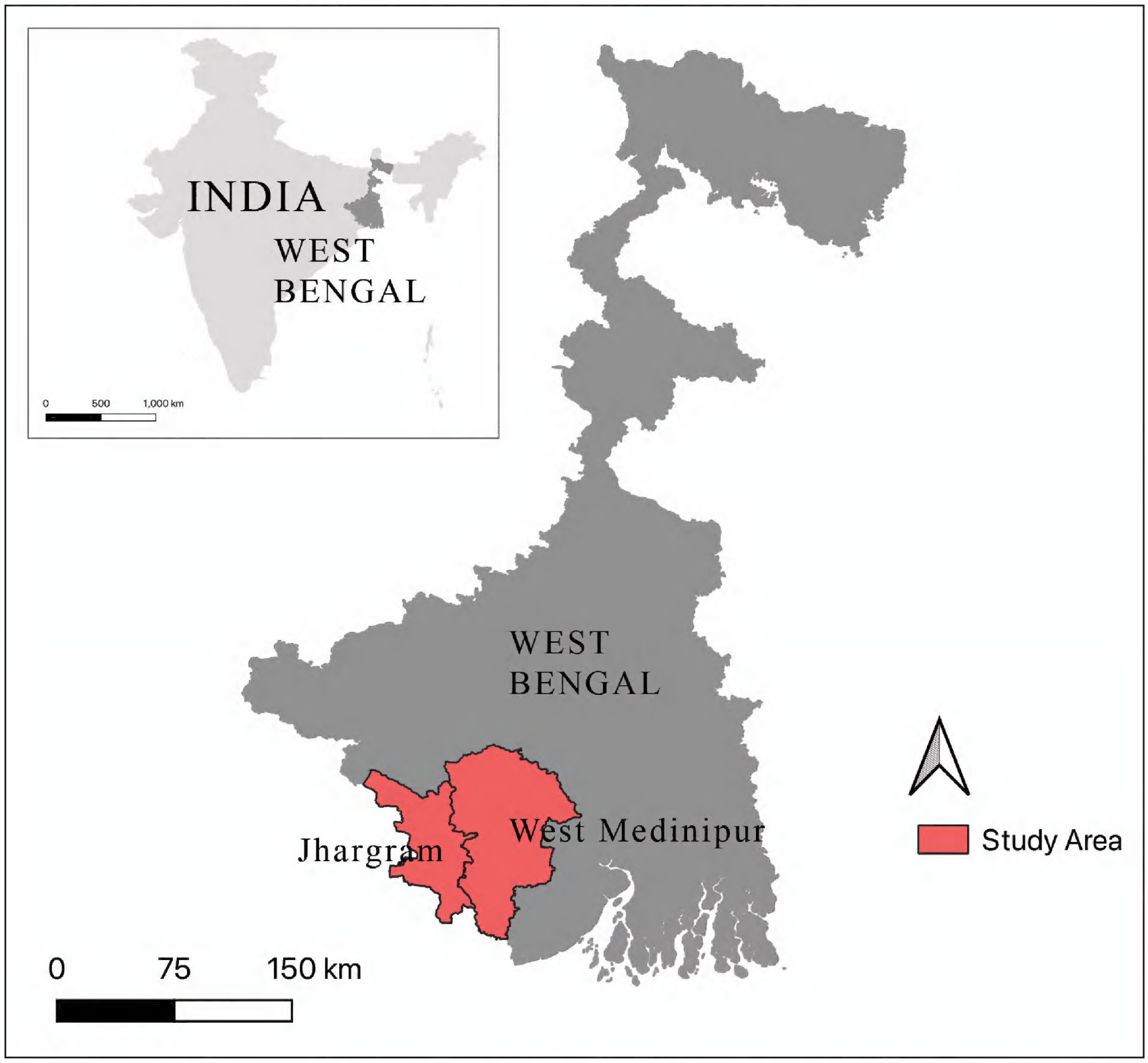


Figure 1. Map showing the location of Jhargram and West Medinipur districts in southern West Bengal, India. Administrative boundaries data source: https://www.diva-gis.org/gdata; mapping software: QGIS (www.qgis.org). The boundaries shown, and the designations used on this map may not be correct and do not imply any official endorsement and/or acceptance by the authors or their respective institutional affiliations.

and its biodiversity. Key questions related to the nature of the hunting event, personal and commercial use of hunted animals, the significance of ritualistic hunting to people, and willingness to engage in potential non-consumptive wildlife-friendly alternatives. For this study, we define "non-consumptive wildlife-friendly alternatives" as activities which do not involve the deliberate killing of animals (in contrast to consumptive practices such as hunting) or have a negative impact on species conservation or individual animals' welfare.

We interviewed participants who self-identified as having engaged in ritualistic hunting (either in the past or present) and were willing to participate in the study, through a process of chain referral (Newing 2011), whereby participants recommended other potential participants, or persuaded others to take part. This snowball sampling approach (Babbie 2004) is useful when researchers are interested in the opinions of a particular hidden population (Potgieter et al. 2017) and, in this case, ensured that participants who could provide information pertinent to the study were selected as representatives of the ritualistic hunting community. Our

aim was not to extrapolate our results to the wider community but to thoroughly understand what drives the hunters we interviewed to take part in ritualistic hunts.

Participants were initially asked some non-hunt related questions such as what pets they keep before being asked about their involvement in ritualistic hunting in an attempt to create a comfortable and relaxing environment (Newing 2011).

Specifically, participants were asked to identify the 10 wild animals (using local common names) that they currently considered to be the most profitable (as opposed to most valuable per item or most commonly traded, with wildlife body parts and live animals considered separately), the 10 wild animals that they considered to be the most desirable (i.e. attractive and useful), and the 10 wild animals that they considered to have most increased in rarity (and therefore inferred reduced availability) over the past five years (corresponding to the period 2017–2021). Common names relating to taxonomic class (e.g., bird and mammal) or below were included in the analysis of the survey responses but were excluded when considering conservation status. Participants were also asked to provide additional information including the wildlife body parts sold per unit, price paid per unit, where the body parts were sold (locally / nationally / internationally), and their intended purpose categorised as "food" (wild meat and other nutritional use), "spiritual" (e.g., items to invoke magic, good luck and prosperity), "medicinal" (ingested or topical treatments for illness), "clothing and decoration" (for fashion and aesthetic purposes), and "unknown" (which included unknown purposes).

Interviews were conducted in Bengali and later translated into English. In accordance with the British Sociological Association Statement of Ethical Practice (BSA 2017), informed consent was obtained verbally from every survey participant prior to the interview. The objectives of the study were explained to participants, and they were made aware of their rights to voluntarily participate or to decline. No identifying participant or household data were collected, and the database collated was entirely anonymous. In addition, villages were coded in the database and village names not reported to further protect study participants from harm or discrimination (St John et al. 2016). Ethical approval was obtained via Manchester Metropolitan University on 06/09/2022, EthOS Reference Number: 43711. When asked about the species involved, participants gave common names in their local language. Scientific names were inferred where possible, otherwise common names are reported. For species whose scientific name could be assigned, its current conservation status and population trend was obtained from the IUCN Red List of Threatened Species (https://www.iucnredlist.org/).

Data analysis

We used descriptive statistics, frequency histograms and pie charts to describe, and to illustrate, patterns in the data. Chi-squared tests of association were used to describe the distribution of age groups and the education level of participants, and to test for differences in perceived trends in the number of animals in the forest, and among rankings for proposed drivers for taking part in hunting rituals. Spearman's rank correlation was used to assess the relationship between the species that were stated as becoming increasingly rare and the declared most desirable and most profitable species. Word clouds were used to summarise and to illustrate the answers given to open-ended questions where there was sufficient text available (excluding the terms "activity" and "animals"); otherwise,

we described the key words used by hunters to describe their actions or feelings. Data descriptions and statistical analyses were carried out in R (version 4.2.3; R Core Team 2023); word clouds were based on a data frame containing the most frequently used words and their respective frequency of occurrence, obtained using the text mining package "tm" (Feinerer et al. 2008; Feinerer and Hornik 2018), and drawn using the "wordcloud" package (Fellows 2018). All interviews were included in the analysis even if they contained missing data. Monetary values were reported in Indian rupees (INR) and converted to US dollars (USD) using 1 INR = 0.0121 USD (conversion rate as of 10.08.23, xe.com).

Results

Hunter demographics

We interviewed a total of 112 people (hereafter respondents) from 93 villages in two districts of West Bengal: Jhargram (n = 59), and West Medinipur (n = 53). Ninety-nine respondents identified themselves as hunters; 13 respondents self-identified as "non-hunters" but provided information on someone else who engages in hunting. All but one of the respondents were male (one of the non-hunters was female). Respondents ranged in age between 18 and 76, with an approximately even distribution across age groups (grouped as 18–25, 26–35, 36–45, 46–55, 56–65, > 66: $\chi^2 = 2.92$, df = 5, p = 0.712) and an average age of about 40 (median = 38.5, mean = 41.6, n = 56; where respondents gave an age range rather than a precise number of years we used the mid-value so the average may be slightly underestimated). Where sample size does not equate to 112, the remainder did not answer the question. Most (n = 81, 72.3%) respondents were married (15 were unmarried and one was widowed). Most reported owning one house (n = 90, 80.4%, two reported owning two houses), and most had lived in the village since birth (n = 98, 87.5%). Others had lived in the village for between 5 and 50 years (n = 7, 6.3%), "since marriage" (n = 1, 0.9%), or described themselves as "resident" (n = 3, 2.7%) or "migrant" (n = 3, 2.7%) but did not say how long they had lived there. Households reportedly comprised between two and 14 people (mean = 5.9, n = 78) and included between one and three children, mostly (n = 20) two children (mean = 1.8, n = 39). Two (1.8%) respondents reported, respectively, "10–15" and "12–20" people in the household.

The education level of respondents varied and was split relatively evenly amongst those that had reportedly not received any formal education (n = 20, 17.9%), educated to primary level (n = 27, 24.1%, included one who was only "nursery" educated), or to secondary level (n = 17, 15.2%, including 9 at "secondary" level and 8 at "higher secondary" level), but only five (4.5%) respondents were educated to college level ($\chi^2 = 9.10$, df = 3, p = 0.028, education level grouped as "no formal education", "primary", "secondary" and "college"). When asked for their ethnicity, most respondents (n = 72) reported only that they were "Adivasi" (a term usually used to refer to Scheduled Tribes in official records, Paliwal 2023), an additional eight respondents stated that they belonged to the Santal tribe and twelve belonged to the Mahato community. Others reported that they belonged to the Bauri (n = 1), Kurmi (n = 1), or Majhi (n = 1) community. Two respondents referred to themselves as "General" (i.e., a person that does not self-identify as belonging to any of the government categories for Indian citizens, Wankhede 2021). When

asked about their main job, 96 respondents reported "cultivation" (predominantly of rice; n = 95), three reported "contract labour" or "contractual work", five reported both cultivation and contract work; one was a government employee, one a retired government worker, one "collected raw materials from the forest", one was unemployed, and two were students. Collectively, 98 (87.5%) respondents reported that agriculture was their primary source of income. One man who reported collecting raw materials said that his primary source of income was selling plates made from Sal tree (*Shorea robusta*) leaves. Annual income ranged from 10 to 150 thousand rupees (equivalent to approximately 121–1,815 USD), although for this question only 30 respondents provided an answer. The following results focus only on the responses of the 99 respondents who self-identified as hunters.

Characteristics of the hunt

When asked about how frequently they had been involved in ritualistic hunting (hereafter 'hunting'/ 'hunts') in the last 12 months, the majority (82.7%) of respondents who answered the question (n = 75) said that they took part in hunts only once or twice ("once": n = 55, "1–2 times": n = 7). A small number of hunters (n = 10) reported that they were involved in more frequent hunts: seven took part in hunts between two and five times in the last 12 months, and three reported taking part, respectively, seven times, 13–14 times, and "many" times. Three respondents reported that they had not taken part in a hunt in the last 12 months (although two of these confirmed that they had taken part in hunts 2–3 or 3–4 times in the last 5 years); 24 did not answer the question. Accordingly, the majority of hunters reported taking part in between one and 15 hunts over the last five years, most (n = 48, 77.4% of the 62 respondents who gave numeric answers to this question) stated five or fewer; two respondents reported taking part in, respectively, 25 hunts, and 35–40 hunts.

All but one of the survey respondents (who did not answer this particular question), described "thousands" of people collectively taking part in a ritual hunt, in hunting parties of 20–40 people (overall minimum 10, maximum 200 or 300), using spears (Ballam/ Kencha; n = 87), bows and arrows (Kaar baansh/ Teer dhonukh; n = 71), catapults (Batul/ Gulti; n = 56) and a range of other methods including hand axes (Tangi) and wooden sticks (Lathi; Fig. 2A). Seven respondents reported setting snares ("lasso's", Faand) alongside other 'direct' methods; only two respondents reported using guns (Fig. 2A). One respondent reported only using snares. Most respondents (n = 79, 79.8% of all respondents) estimated that the total number of people involved in the hunt was between 4,000 and 5,000, a small number of respondents suggested that the overall total might reach 6,000 (n = 4), 7,000 (n = 1) or as high as 10,000 (n = 5). Two respondents reported that only tribal people participated in the hunt; but, with the exception of one respondent who did not answer the question, most (n = 96, 97.0% of all respondents) stated that the "majority" of people taking part in the hunt were tribal, and 91 of these explicitly stated that a few of the people taking part were non-tribal.

The best time for hunting was most commonly reported to be between March and May (n = 73 respondents suggested one, or a range of months, within this period), although some hunters suggested that hunting could start as early as January or February, and others suggested that it could take place later in the year (starting in April/May and extending to June/July) (Fig. 2B).

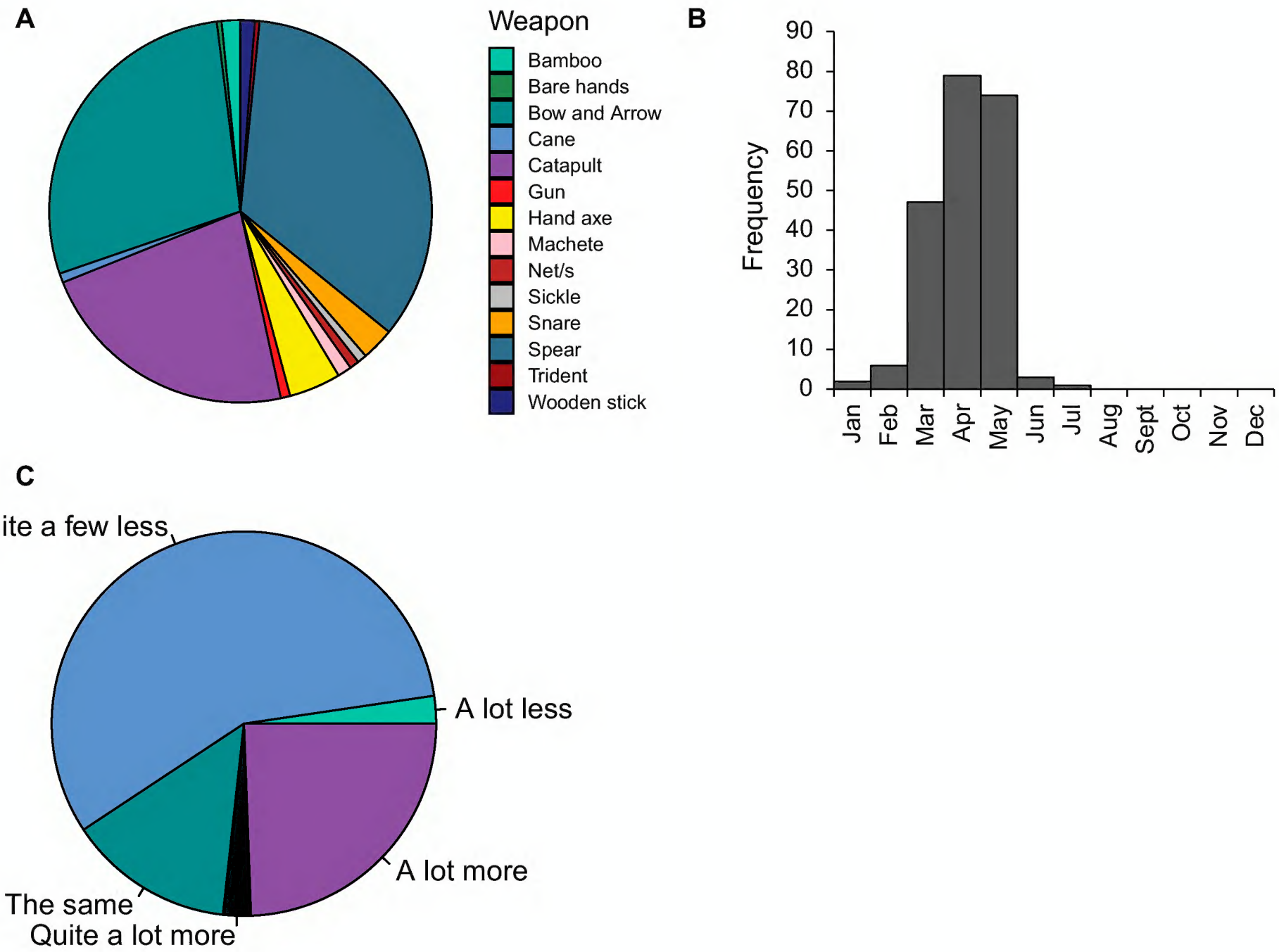


Figure 2. A pie chart showing proportion of hunters using different hunting/killing methods during ritualistic hunting in West Bengal. In most cases, hunters reported using more than one method (five hunters said they only used spears, and one only used snares) and so the number of methods exceeds the number of survey respondents (n = 99 hunters, n = 252 methods reportedly used; 10 survey respondents did not say which methods they used) **B** bar chart showing the months reported to be best for hunting. Where hunters suggested a range of months, we counted each month within the specified range, and so the total frequency of months being specified as 'optimal' exceeds the number of survey respondents (n = 99 hunters, n = total frequency of months specified; 13 survey respondents did not answer the question) **C** pie chart showing perceived trends in the number of animals in the forest compared with 5 years ago (based on the answers of 75 hunters), five-point scale: a lot less / quite a few less / the same / quite a lot more / a lot more.

Estimates of the number of animals captured and killed, by the hunting party, in the last 12 months, varied between 1–2 and, in most cases, up to 20 (with most respondents answering towards the lower end of this range: mean = 4.1, median = 2.5, n = 61, excluding one outlier); three respondents reported that the hunting group captured and killed 20–25, 25–30, and 100–200 animals, respectively. Accordingly, estimates of the number of animals captured and killed by the hunting party over the last five years were predominantly (n = 43) between 10 and 50; 11 respondents estimated that the hunting party had captured and killed fewer than 10 animals in the last five years. Six hunters suggested that the numbers captured and killed over the last five years exceeded 50: four estimated 50–100, one > 100, and one 1,000–2,000 (one hunter reported that they had "lost count").

Fifty-four survey respondents stated specifically that the animals captured are "slaughtered at home" (some that they are taken to the "leader's" house

where they are slaughtered and divided), 32 described "slaughtering" and cooking animals in the forest (three of these also said that the animals were eaten in the forest). Two respondents explained that if they are hunting far away, and stay overnight in the forest, the animals are slaughtered there but otherwise they bring them home, and six refer to slaughtering animals at home or in the forest (three also said that the "excess" is brought home). Respondents referred to transporting the animals killed by carrying them on their shoulders (in some cases with their feet tied to sticks), on bikes, or in jeeps or other 4-wheelers.

Species diversity

Overall, during our survey, the 99 respondents who self-identified as hunters used 74 different local names to refer to 53 distinct different common names of the most desirable and profitable wildlife species that they currently hunt (plus at least four unidentified animals), comprising 36 common names referring to birds (67.9%), 11 to mammals (20.8%), five to reptiles (9.4%), and one insect (ants) (Suppl. material 2). Overall, we estimate that the 53 distinct common names provided by hunters to refer to the most desirable and profitable wildlife species hunted (excluding invertebrates i.e., 'ants' [Formicidae]) potentially refer to at least 93 species within the study area in West Bengal, including 73 birds (Aves), 15 mammals (Mammalia) and 5 reptiles (Reptilia). This is assuming that a common name could refer to multiple species of the same taxon; for example, the local name 'titir pakhi' meaning 'francolin' could potentially refer to two francolin species found in West Bengal: the grey francolin (*Ortygornis pondicerianus*) or black francolin (*Francolinus francolinus*); see Suppl. material 2.

Most desirable species

A total of 52 unique common names were given when participants were asked to list the 'ten most desirable wildlife species or body part from ritualistic hunting'. All respondents (n = 99) provided answers, and respondents each listed 2–15 species. The total number of species mentioned was highest for birds (n = 35 species) followed by mammals (n = 11), reptiles (n = 5) and insects (ants, n = 1). The most frequently mentioned common names (scientific names are inferred) for the 'ten most desirable wildlife species hunted' were wild boar (*Sus scrofa*, n = 99 mentions, 100% of hunters), followed by Indian hare (*Lepus nigricollis*, n = 96, 97.0%), greater coucal (*Centropus sinensis*, n = 64, 64.6%), quail (Phasianidae, n = 53, 53.5%), collared dove (*Streptopelia decaocto*, n = 47, 47.5%), yellow-footed green pigeon (*Treron phoenicopterus*, n = 47, 47.5%), jungle cat (*Felis chaus*, n = 41, 41.4%) and Bengal monitor (*Varanus bengalensis*, n = 22, 22.2%) (Fig. 3). In addition, two local names mentioned in relation to the most desirable species could not be identified to a single species level: francolin (c.f. grey francolin or black francolin; n = 29, 29.3%) and mongoose (c.f. Indian grey mongoose (*Urva edwardsii*) or small Indian mongoose (*Urva auropunctata*); n = 28, 28.3%). Five local names given for the most desirable species were unidentified (Suppl. material 2).

A total of eight different body parts related to the 52 most desirable species that were mentioned at least once, with 'whole body' being most frequently cited (94% of a total of 757 species and body part combinations mentioned. Note: each respondent listed up to 15 most desirable species) (Fig. 3). With the excep-

tion of one respondent who reported consuming ants alive, all other desirable species were used as dead animals. Across all respondents, the most frequently cited purpose of hunting the most desirable species was for 'consumption' i.e., food (94%, n = 713 mentions), three respondents cited 'spiritual' use (e.g., bones of Indian flying foxes (*Pteropus medius*) used to "ward off odd/evil spirits" (n = 2), and wild boar head used "for new born kids to ward off evil spirits" (n = 1)), one referred to 'medicinal' use (for the body and head of wild boar), and one referred to the making of 'clothing and decoration' items (Bengal monitor skin used "for preparation of belts"). Seven respondents explicitly stated that some of the most desirable species were "not consumed" (in relation to whole dead golden jackal (*Canis aureus*; n = 2), whole dead animal and bones of the Russel's

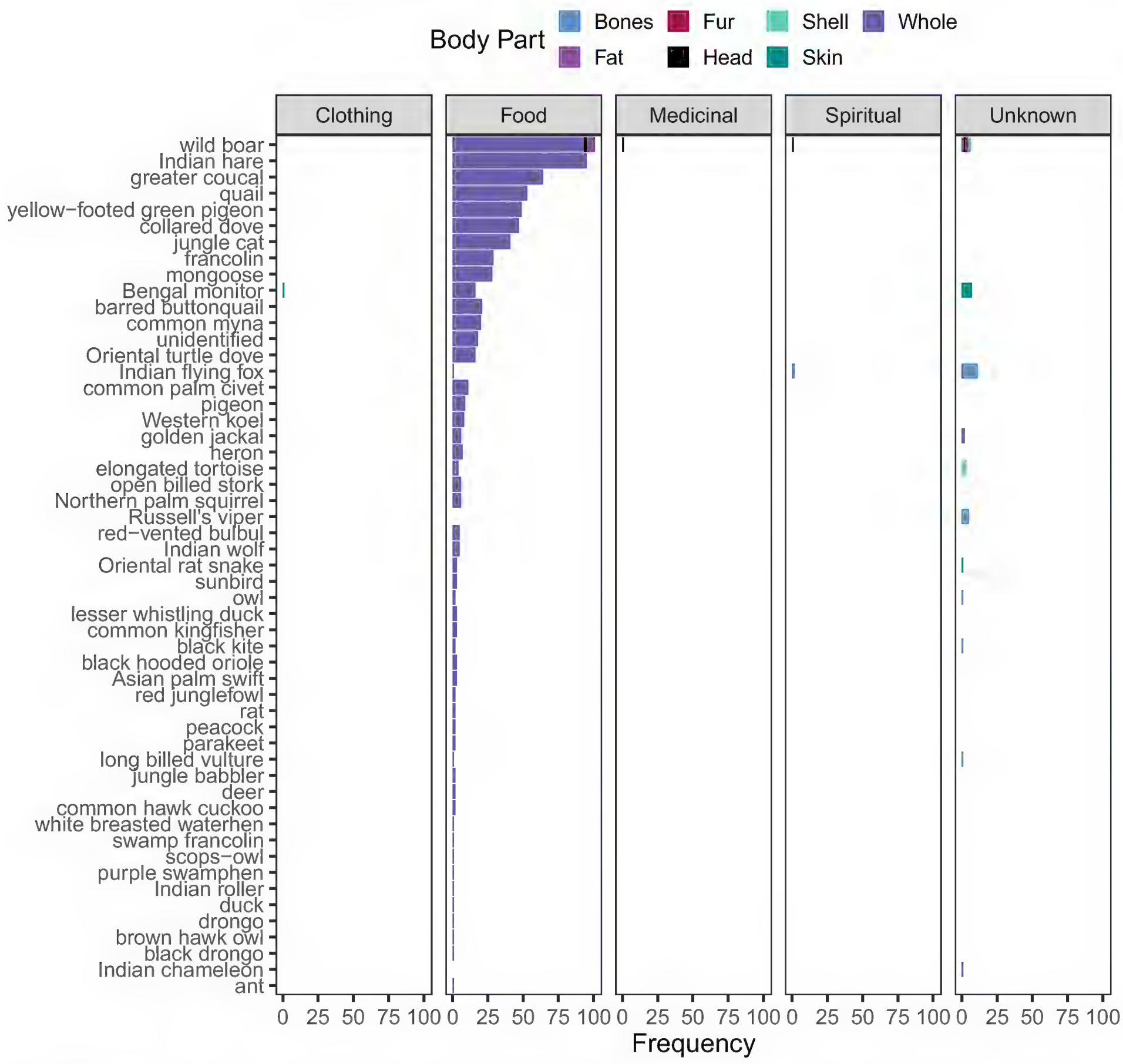


Figure 3. Breakdown of most desirable species by body part and purpose. Frequency refers to the number of times a respondent reported each purpose of use of desirable species' body parts. Note: the responses were categorised as "clothing and decoration", "food", "medicinal", and "spiritual" based on their inferred meaning (see text for full description of items within each category). The full list of common names provided along with local and inferred scientific names is given in Suppl. material 2.

viper (*Daboia russelli*; n = 1), and the bones of Indian flying foxes (n = 4)). The purpose of hunting of the most desirable species was unknown or could not be determined for 5.1% (n = 39) of responses. For example, the Indian chameleon (*Chamaeleo zeylanicus*) was reportedly used for "other uses", eight hunters who listed Bengal monitors as a desired species used their skins or hunted them exclusively for their skins, but the purpose of the skins was unknown, and two of the eight respondents who reportedly desired catching golden jackals said that they did not consume them but did not say what they used them for.

Only six respondents provided sale prices for the most desirable species; the most expensive items were reportedly derived from red junglefowl (*Gallus gallus*, Rs 2200–2300 (~26–27 USD) per whole animal for consumption) and Indian hare (Rs 500 (~6 USD) per animal for consumption) (Suppl. material 3).

Most profitable species

Sixteen unique common names (6 birds, 5 mammals, and 5 reptiles) were given when participants were asked to list the 'ten most profitable wildlife species or body part from ritualistic hunting' (n = 58 provided answers, and respondents each listed 1–5 species). The most frequently mentioned common names were wild boar (n = 53, 91.4%), followed by Indian flying fox (n = 13, 22.4%), Bengal monitor (n = 8, 13.8%), Russell's viper (n = 6, 10.3%), and elongated tortoise (*Indotestudo elongata*, n = 6, 10.3%) (Fig. 4, Suppl. material 3).

Eleven different body parts related to the 16 most profitable species mentioned with 'bones' being most frequently cited (n = 43, 27% of a total of 159 species and body part combinations mentioned), along with 'fat/oil' (n = 26, 16.4%), and 'head/head parts' (n = 14, 8.8%) (Fig. 4). Across all respondents, the most frequently cited purpose for hunting of the most profitable species was for 'spiritual' use (n = 69, 43.4%). This included wild boar teeth, head parts, tusks and bones (n = 34), as well as the bones of Indian flying fox (n = 14), vultures (*Gyps* sp.; n = 5), owls (Strigidae; n = 2), Russell's viper (n = 4), and black kite (*Milvus migrans*; n = 1), all believed to "ward off ill-omen" or "evil spirits". The second most frequently cited purpose was 'medicinal' (n = 31, 19.5%). This included wild boar teeth and bones (n = 1) and head (n = 1) used "for preparation of medicines" or "consumed as a medicine during fever" (n = 2), wild boar bones used as "a medicine for back pain" (n = 1), and fat used for "body pain" (n = 2), "joint pains" (n = 10), or "massage" (n = 2). Additionally, fats of the Bengal monitor were used "for preparation of medicine" (n = 1), "to treat joint pain" (n = 1), or "as an ointment to cure swelling and blisters" (n = 2). Tortoise shell was used "in combination with oil to cure body pain" (n = 4), Russell's viper bones used "to make medicines" (n = 2), and Indian rat snake (*Ptyas mucosa*) tails were "cooked with spinach and consumed to treat ear pain" (n = 1). Other purposes cited included 'consumption' (i.e. food; n = 17, 10.1%), 'clothing and decoration' (n = 8, 5%), which included wild boar head parts "worn as bangles", and bones of Indian flying foxes "worn over the waist") and 'manufacturing goods' (n = 7, 4.4%), such as Bengal monitor skin used for "making musical instruments" and wild boar fur used "as a bicycle brush". For 16.9% (n = 27) of responses, the purpose of use of the most profitable species was unknown or could not be determined.

Seventeen respondents provided prices for the most profitable species; the most expensive individual items were derived from the Bengal monitor (Rs

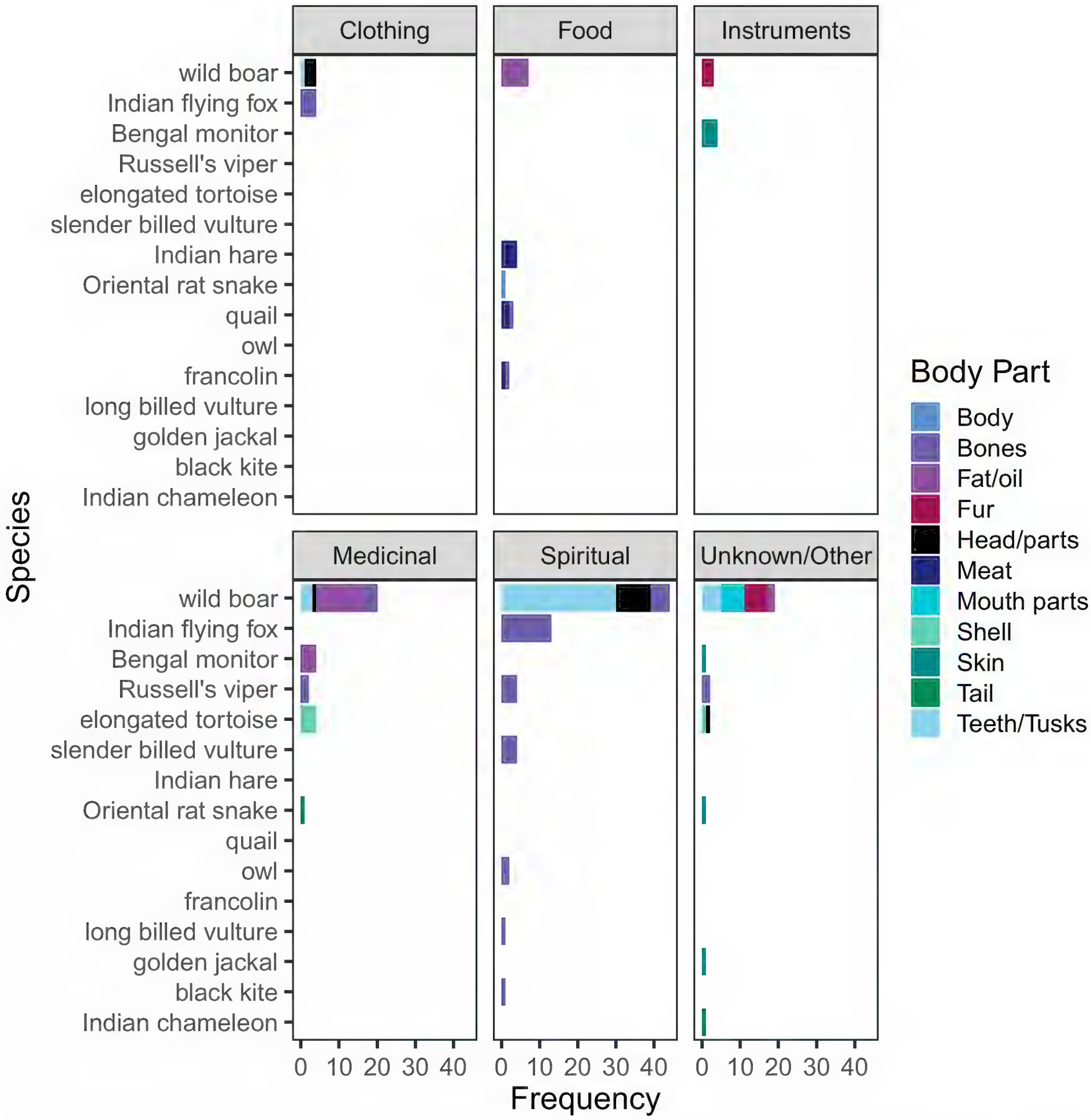


Figure 4. Breakdown of most profitable species hunted by body part and purpose. Frequency refers to the number of times a respondent reported each purpose of use of profitable species' body parts. Note: categories were inferred during analysis ("Unknown/Other" includes unknown purposes (n = 21) and wild boar "mouth parts" used to "stop children crying" (n = 6); see text for full description of items within each category).

3000–4000 (~36–48 USD) per whole animal skin), Indian hare (Rs 700–800 (~8.4–9.6 USD) per kg or Rs 500 (~6 USD) per animal for consumption), and Russell's viper (Rs 500–600 (~6–7.2 USD) per 'piece' of bones) (Suppl. material 3).

Hunting for personal use

When asked specifically if they hunted for personal use, while all 99 hunters interviewed reported that they used the animals hunted for personal 'consumption' (i.e. food), 41 of these also referred to "other uses". Other uses were most often

associated with wild boar – specifically, the fat oil (used for "massage for joint pains", cooking, or traditional medicine; n = 18), the teeth, tusks, or "head parts" (to ward off "bad omens", "evil spirits" or to avoid "bad luck"; n = 33, one also said that they kept the head as a souvenir after they had sold the body for meat), the fur (used as a brush for a bicycle; n = 11), or the bones (used for medicine; n = 1). Respondents also mentioned using the bones of Indian flying fox, birds, owls, or Russell's vipers, primarily to "ward off bad omens" or "evil spirits", or (occasionally) for medicine (n = 14), tortoiseshell to treat pain (n = 1) or the skins of Bengal monitors, Indian rat snakes, or golden jackals for unknown purposes (n = 3). Thirteen respondents in this set of questions referred to "other people" using these body parts, or that they were "not sure of the purpose" suggesting that they did not necessarily do these things themselves and were not particularly familiar with these types of use. Three respondents mentioned the personal use of giving wild boar teeth or "mouth parts" to small children (to stop them crying or eating mud).

Hunting for commercial use

When asked specifically if they hunted for commercial use, approximately a quarter (n = 27, 27.3%) of respondents said that they sold meat from the hunt at local markets, and 17 said that they sold the body parts "locally". Meat and body parts were reportedly sold for local consumption (one said that they sometimes gave the meat to relatives in different districts). Of the 27 respondents that sold the meat, 24 specifically stated that the meat was sold only when there was excess available. Hunters reportedly received between Rs 150 and 200 (~1.8–2.4 USD) per kilogram of meat sold (either 'meat' of an unspecified species or 'wild boar'); two hunters suggested as much as Rs 300 (~3.6 USD) per kg for wild boar meat, one hunter suggested Rs 150 (~1.8 USD) per kg for golden jackal meat, and two suggested, respectively between Rs 250 and 300 (~3–3.6 USD) for a "rabbit", or Rs 500 (~6 USD) for a whole Indian hare. One hunter suggested that francolin and quail were also sold live for Rs 200–300 (~2.4–3.6 USD). One respondent reported that Indian rat snake meat was eaten (but no price was given).

When asked what the body parts were used for when sold, the answers given were similar to those for personal use: respondents most often referred to the use of wild boar teeth, head, or "mouth parts" (n = 33; often as a "garland" (mala)) to ward off bad omens (or sometimes to "stop children eating mud"), or the use of wild boar oil or fat (n = 19) for joint pain, cooking, or tooth ache. The bones of owls, birds (black kite, slender billed vulture (*Gyps tenuirostris*)[2] and long billed vulture (*G. indicus*) were mentioned specifically), and Indian flying foxes were also reportedly used for "warding off evil spirits" (n = 11). Bengal monitor fat was sold for medicine and their skins for musical instruments (dug-dugi and behala). Other body parts sold included wild boar fur, tortoise shell, and the skins of Indian rat snakes and golden jackals.

A pair of wild boar teeth were reportedly sold for Rs 30–40 (~0.4–0.5 USD), a wild boar head for Rs 50–60 (~0.6–0.7 USD), wild boar fur for Rs 100 - 200 (~1.2–2.4 USD) (per 250 g), a whole snake for Rs 40–50 (~0.5–0.6 USD) (although the bones of Russell's viper were reportedly sold in local markets for Rs

2 It is possible that this species was an incorrectly identified long-billed vulture or Himalayan griffon (*Gyps himalayensis*).

50–60 (~0.6–0.7 USD) per snake, Rs 150 Rs (~1.8 USD), or Rs 500–600 (~6–7.2 USD)), and Rs 200 (~2.4 USD) for a pair of birds' legs. One hunter reported that golden jackal skins sold in local markets for Rs 400–500 (~4.8–6 USD). The highest prices reported were Rs 2200–2300 (~26.5–27.8 USD) per bird for a junglefowl and Rs 3000–4000 (~36–48 USD) for a monitor lizard.

Perceptions of increased rarity

Hunters' perceptions of the trend in the number of animals in the forest compared with 5 years ago differed significantly from what might be expected under an equal random distribution ($\chi^2 = 38.71$, df = 4, $p < 0.001$): of the 75 hunters that answered this question, 51 (68%) believed that there were fewer animals in the forest than there were 5 years ago (n = 49 that there were "quite a few less", and 2 that there were "a lot less", Fig. 2C). Nevertheless, opinions varied: 23 (30.7%) believed that there were more (n = 2 "quite a lot more", and 21 "a lot more") and 12 (16%) believed that there were the same number (Fig. 2C). One interviewee stated that there had been an increase in the number of wild boars in the forest. 24 interviewees did not answer the question.

When asked which (if any) wild animals had become rare and/or unavailable in the last 5 years, respondents (n = 50) collectively listed 10 species that they believed had become extremely rare (including tigers (*Panthera t. tigris*), sloth bears (*Melursus ursinus*), and vultures), 21 that they believed had become slightly rare (mostly bird species, but also golden jackals, jungle cats, and wild boar), and four that were reported to be either extremely or slightly rare by different interviewees (deer [Cervidae], Indian wolf (*Canis lupus pallipes*), barred buttonquail (*Turnix suscitator*), and peacock (*Pavo cristatus*)) (Suppl. material 2). Forty-nine interviewees did not answer the question and those who did answer listed 1–4 species.

The most frequently mentioned common names for the 'ten species which have become rare or unavailable in the last five years' were 'deer' (n = 11, 12.8% of a total of 86 mentions), followed by 'slender billed vulture' (which may or may not have been misidentified, see footnote 2, n = 8, 9.3%), 'Indian hare' (n = 7, 8.1%), 'crow' (Corvidae; n = 6, 7.0%) and 'tiger' (n = 6, 7.0%) (Suppl. material 2). Twenty-five species that were perceived as having become 'rare or unavailable in the last five years' were also listed among the ten most desirable animals hunted, including 'wild boar', 'collared dove', 'yellow-footed green pigeon', and 'jungle cat'. Eight species that were perceived as having become 'rare or unavailable in the last five years' were also listed among the ten most profitable animals hunted, including 'wild boar', 'Indian hare', and 'slender billed vulture' (see footnote 2, Suppl. material 2). When considering all common names (n = 59) provided by respondents, no correlation was found between the species that were stated as becoming increasingly rare and the declared most desirable species (Spearman's rho = 0.126, p = 0.345) or most profitable species (Spearman's rho = 0.038, p = 0.776).

Only 24 respondents suggested reasons why animals had become rare – of these, 11 (45.8%) suggested that it was due to hunting and 8 (33.3%) suggested it was due to deforestation or burning the forest (sometimes by hunting parties). Other suggested reasons included: irregular rainfall, disease, animals migrating to different areas, and the ignorance of the forest department. Two respondents reported that the number of animals/birds had increased, one due to hunting, and one because people were not able to enter the forest due to elephants.

Species conservation status

With regards to international conservation status, three of the 93 inferred hunted species (3.2%) are currently categorised on the International Union for Conservation of Nature (IUCN) Red List as Critically Endangered (elongated tortoise, long billed vulture, and slender billed vulture [see footnote 2 regarding the latter]), four (4.3%) as Vulnerable (common pochard (*Aythya ferina*), swamp francolin (*Ortygornis gularis*), pale capped pigeon (*Columba punicea*), and Sambar (*Rusa unicolor*)), four (4.3%) as Near Threatened, 81 (87.1%) as Least Concern, and one sub-species (Indian wolf) is Not Evaluated (Fig. 5A, Suppl. material 2).

With regards to their population trends, 10 (10.8%) inferred species have wild populations considered to be increasing, 29 (31.2%) have wild populations that are stable, 34 (36.6%) that are decreasing, 19 (20.4%) have an unknown population status, and for one sub-species (Indian wolf) the population trend has not been assessed (Fig. 5B, Suppl. material 2). An additional 28 inferred species (27.7%) that are not currently considered as threatened (according to the IUCN Red List i.e. they are listed as Near Threatened, Least Concern or have not been assessed), were believed by hunters to have increased in rarity (Suppl. material 2). With regards to their status under the Indian Wildlife Protection Act 1972, 25 (26.9%) inferred hunted species are listed under Schedule I of the Act, 64 (68.8%) are listed under Schedule II, four species are not listed (Fig. 5C, Suppl. material 2).

Motivations and alternatives

When asked how they felt about ritualistic hunting, all but one of the hunters reported that they strongly liked it (one exception amongst the hunters said that they quite disliked hunting). The 13 non-hunters also reported that they 'strongly liked' ritualistic hunting when asked how they felt about the practice. The seven potential drivers for taking part in hunting rituals presented to hunters dif-

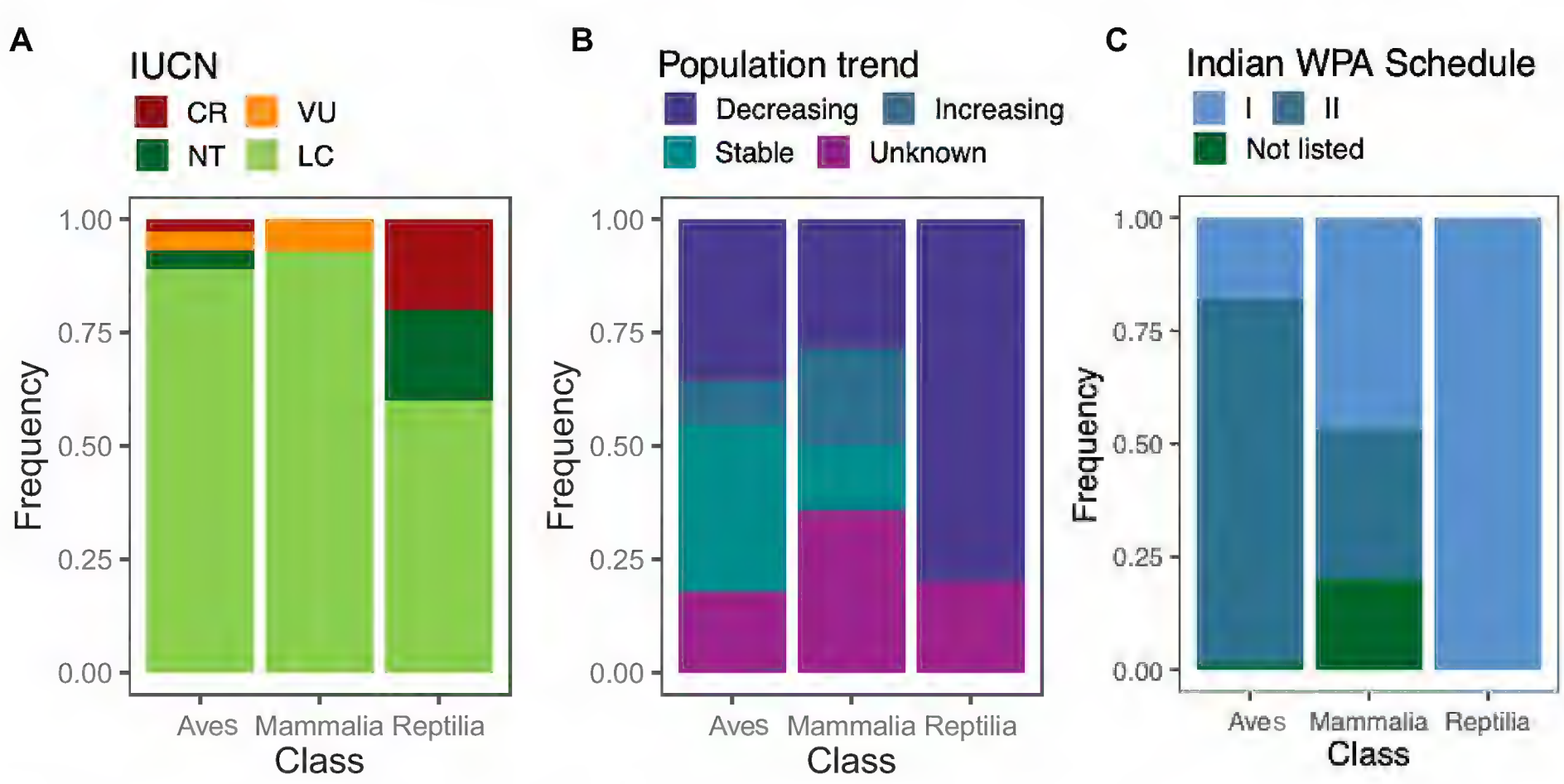
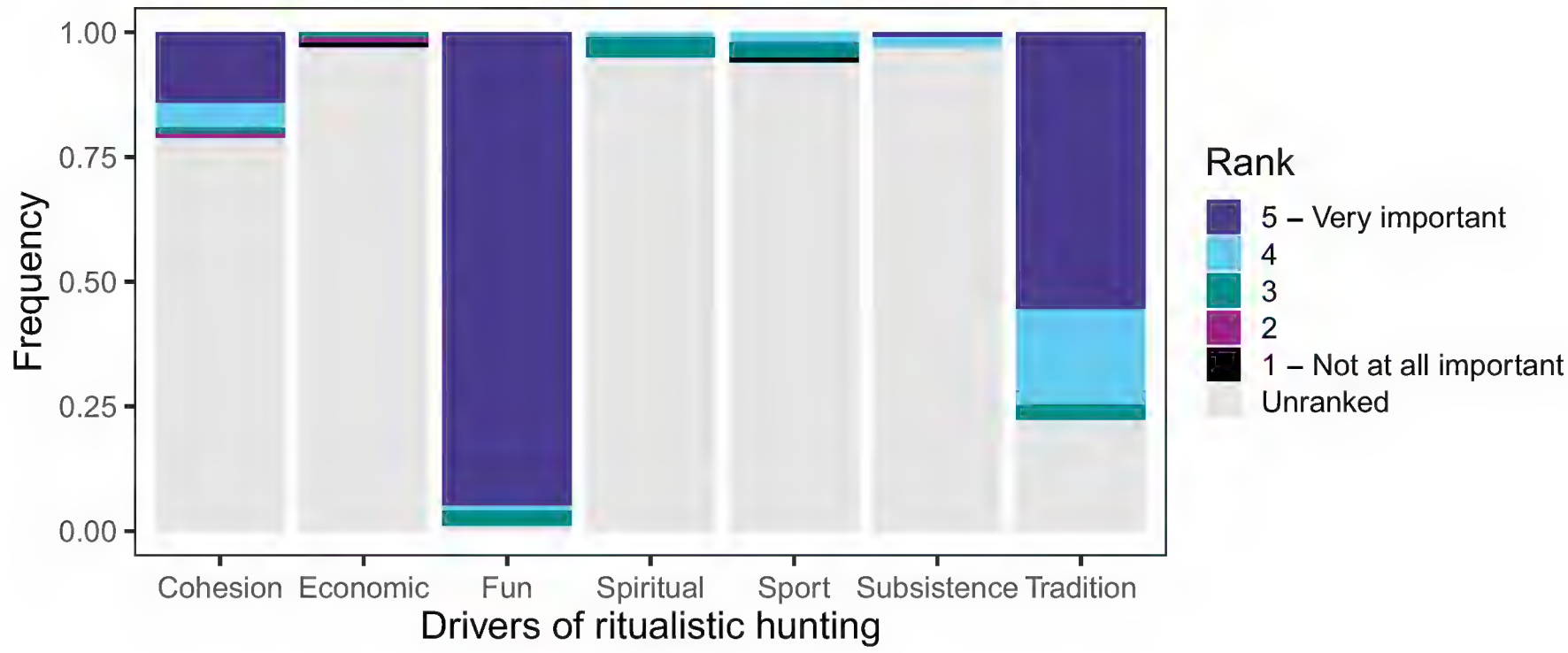


Figure 5. Breakdown of **A** IUCN Red List status **B** population trend, and **C** Indian Wildlife Protection Act 1972 Schedule status for the species listed as either the most desirable or most profitable species hunted.

fered in their reported importance with 'Fun' and to a lesser extent 'Maintaining a traditional practice' statistically significantly more often highly ranked (ranks 4 or 5; ranked on a scale of 1–5, where 1 is not at all important and 5 is very important) than low or unranked (fun: $\chi^2 = 50.72$, df = 1, $p < 0.001$; traditional practice: $\chi^2 = 11.88$, df = 1, $p < 0.001$, ranks 4 and 5 combined and ranks 3, 2, 1 and unranked combined, tested against an even distribution of responses between "important" and "unimportant" ranks, Fig. 6). Whereas hunting as a 'Sport', 'Economic opportunity', or for 'Subsistence benefits', or 'Spiritual benefits' were significantly more likely to be unranked or ranked low (not important) than ranked high (important) (sport: $\chi^2 = 56.75$, df = 1, $p < 0.001$; economic: $\chi^2 = 63.36$, df = 1, $p < 0.001$; subsistence: $\chi^2 = 53.66$, df = 1, $p < 0.001$; spiritual: $\chi^2 = 59.98$, df = 1, $p < 0.001$, Fig. 6); these drivers were ranked as important or very important by

A



B

Figure 6. A importance of eight potential drivers for taking part in ritualistic hunts. Drivers were proposed by interviewers and ranked by respondents on a scale of 1–5, where 5 was "very important" and 1 was "not at all important". Data given are the number of respondents giving a particular rank (we assume that a hunter that did not rank a particular driver – categorised here as "unranked" – did not consider it to be important) **B** wordcloud showing words used to describe why hunters felt the way they did regarding benefits from hunting to themselves or to the forest. (NB. "paves" was used in the context of "paves the way for…") (based on responses from 66 hunters).

between 0 and 3 respondents. 'Social cohesion' was ranked as important but only by 19 of 99 interviewees; overall, social cohesion was more often unranked or ranked low (unimportant) than important ($\chi^2 = 19.42$, df = 1, $p < 0.001$, Fig. 6A).

Of the 99 hunters, 87 (87.9%) said that they did not currently engage in animal-friendly alternatives to ritualistic hunting. All but two of the 88 interviewees that answered this question suggested that they would engage in potential animal-friendly alternatives if they were available, that they would like to see such alternatives, and that awareness programs should be "organised about birds and animals within the forest, and awareness about snakes, which would not involve hunting" (Note that several respondents gave the same responses to these questions using the same words). Responses to this question were the same for the non-hunters: 10 of 13 did not currently engage in alternatives but gave the same answer about awareness programs (3 did not answer the question).

When asked if hunting provided benefits either to themselves or to the forest, 58.6% (n = 58) answered that hunting benefited them, one answered that it benefited the forest (and did not mention personal benefits), four answered that it provided no benefit to either (36 did not answer the question or were not sure). Of the 58 hunters who reported a personal benefit, 56.9% believed that hunting either did not benefit (n = 29) or was harmful (n = 4) to the forest, 27.6%

Figure 7. A adult and juvenile barking deer killed in Purulia district in 2019 **B** 2 injured monitor lizards (*Varanus salvator*) (including a pregnant individual) captured by hunters in Panskura railway station in East Medinipur district in 2018 **C** hunting weapons, along with hunted wild animals – rose-ringed parakeet, lesser golden-backed woodpecker, white-throated kingfisher, Indian palm squirrel and Indian grey mongoose **D** mongoose meat being cooked in a vessel on a railway platform. Copyright HEAL.

believed that hunting benefited (n = 14) or did not harm (n = 2) the forest (nine did not mention the forest specifically or did not specify a benefit or disbenefit). Personal benefits were attributed to celebration, fun, providing food for their family, and showing off their skills to other hunters, whilst forest benefits were attributed to the numbers of animals in the forest (keeping a "check", and "pav[ing] the way for younger animals") and chopping down old trees (Fig. 6B).

Discussion

Scope and scale

Hunters confirmed that there are a wide range of species across a number of taxonomic groups that would be considered either desirable or commercially valuable captures during ritualistic hunting festival events in West Bengal (Fig. 7). These included mammals such as wild boar and Indian hares, birds such as greater coucals and yellow-footed green pigeons, and reptiles such as Bengal monitor lizards and elongated tortoises. The number of different vertebrate wildlife species reported by hunters (53 common names that infer to potentially as many as 93 species) represents a longer list than that reported in other recently published studies on this issue. For example, Dutta and Mondal (2020) documented 36 wild animal species following interviews with 56 tribal hunters in the Bankura district of West Bengal. The additional 17–74 inferred species reported by hunters in our study include up to four mammals, 66 birds, and four reptile species respectively, bringing the maximum total number of inferred species across both studies to potentially as many as 112 different species of wild vertebrates (Suppl. material 2). Notably, 19 species documented by Dutta and Mondal (2020) were not reported by hunters during our study, these include four mammals (porcupine, Indian civet, fox, small bat), nine birds, four reptiles, and two amphibian species. These differences highlight the value of case studies such as this to garner a more complete understanding of the diversity of species that may potentially be impacted during these types of ritualistic hunts.

With regards to scale, hunters also confirmed that hunting festivals are periodic large collective events involving "thousands" of participants that operate in groups that typically range from 20 to 40 (and up to a maximum of 300) people per "hunting party". This aligns with observations made in other recently published reports. For example, Ghai (2017) described ritualistic hunts typically taking place between January and April every year when men, each of whom are assigned a specific role, go into the forest "en masse" to celebrate the post-harvest season. Similarly, HEAL (2020) estimated that the hunting festivals of South Bengal attract approximately 50,000–60,000 hunters every year, with the number of participants ranging from 1,000 to 15,000 hunters on each occasion, organised into between 50 to 500 members per hunting party. Although the exact number of hunts and participants is not possible to determine, due in part to their illegal nature, it is clear that the number of wild animals that are illegally hunted as a result of these hunting festivals each year can be substantial. For example, based on hunter responses from our survey, even a conservative estimate of 5,000 wild animals per year is reached based on the assumption that 50,000 hunters might take part in hunting festivals over one year, organised into hunting parties of 40 people, each of which captures an average of four individual wild animals.

Consumption and culture

All 99 of the participants in our survey who self-identified as hunters confirmed that the wild animals captured during ritualistic hunts were used for personal consumption of wild meat as part of celebratory feasts and meat-sharing in the village (Ghai 2017). This is not unexpected as the cultural components of ritualistic hunts have been highlighted by previous authors; Ghai (2017), for example, describes spiritual leaders of the tribe determining hunt schedules, victorious return marches, and slaughtered animal offerings to deities prior to food preparation. Moreover, hunting for food has previously been reported as one of the main motivations for hunting among other tribes in Northeast India (e.g., Aiyadurai et al. 2010). Dutta and Mondal (2020) also refer to a preference for Indian wild rabbit for its "tasty meat" among communities residing in the Bankura District of West Bengal and occasional hunting of reptiles and amphibians for their meat. Hunters in this study, in the districts of Jhargram and West Medinipur, also considered Indian "wild rabbit" (i.e., the Indian hare) to be particularly desirable, although wild boar was their most commonly stated and preferred species in this regard. In contrast to Dutta and Mondal (2020), no amphibian species were mentioned by any of the hunters that participated in our study. However, although several hunters mentioned providing food for their family when asked about the benefits of hunting, few (only three) ranked subsistence as an important or very important element of the hunt (or indeed ranked subsistence benefits at all). This finding is also in accordance with Dutta and Mondal (2020) who suggest that there is little need for local communities to hunt for meat these days in the study landscape (see also Kazmi 2021).

In addition, although most of the species perceived by hunters to be "desirable" were reportedly consumed, some had additional or alternative uses – for example, almost 40% of hunters who listed Bengal monitors as desirable species also used their skins, with personal uses described suggesting that this might have been for belts. More broadly, wild animal parts have historically been sold as jewellery, souvenirs and for medicinal/spiritual purposes by tribal communities in India for millennia (Jugli et al. 2020a). To this day, with regards to traditional medicine, villagers often still rely on local village priests and healers who recommend the use of wildlife derivatives due to inadequate healthcare facilities in these types of remote areas (D'Cruze et al. 2018a; Jugli et al. 2020a). Sarkar and Modak (2022), similarly describe how animals have been traditionally targeted during hunting festivals in the Purulia district of West Bengal to provide a rich source of essential nutrients which help to restore the tribe and maintain a healthy reproductive life. Likewise, hunters are also known to use body parts from wild animals that are otherwise consumed for food for spiritual and aesthetic purposes. For example, Dutta and Mondal (2020) noted how the skulls of hunted animals were hung in front of the house as a symbol of prestige, and the colourful feather of the birds to decorate their room in the Bankura district of West Bengal. Ghosh et al. (2013) also refer to birds' feathers as ornaments commonly worn by members of the Santhal tribe during festivals, and similar uses of wild animal parts are described for tribal communities elsewhere in India (Jugli et al. 2020b). Several hunters in this study confirmed that body parts of the most profitable wild animals (particularly wild boar but also Bengal monitor, Indian flying fox, and Russell's viper) were sought for several different cultural purposes, such as traditional medicine, belief-based

practices, and decoration, although it was not clear to what extent hunters used body parts for these purposes themselves as opposed to simply being aware that they might be used in this way.

Economics and enjoyment

Beyond the dominant personal consumption of wild meat and the enduring cultural aspects, our analysis of hunter responses regarding the most profitable wildlife species suggests that these ritualistic hunts also comprise a commercial component (albeit for a relative minority of hunters and largely limited to occasions when there was excess meat available). Notably, approximately half of respondents were able to provide information on the profitability of particular species, but not much more than a quarter said that they sold them themselves (i.e. hunters seemed to be aware of the potential value of the species captured and their body parts but, for the most part, did not personally engage in selling them). Moreover, although some hunters also sold wild animal body parts - including wild boar derivatives, Russell's viper bones, Bengal monitor fat, elongated tortoise shells, Indian rat snake tails, golden jackal skin, and Indian chameleon tails - many were unable to provide information relating to their intended end use. Other recent studies have described cash income as being an important driver for hunting among other tribes in India. For example, Aiyadurai et al. (2010) reported how certain species that have valuable commercial parts, such as otter species, musk deer species, and Asiatic black bears (*Ursus thibetanus*), are hunted primarily for commercial sale. Likewise, previous research has also documented how musk pods, bear gall bladders, and pangolin scales are sold in towns in the neighbouring state of Assam, and in some cases then prepared for export as part of illegal international wildlife trade chains, often without any knowledge of what is responsible for driving consumer demand (e.g. Aiyadurai et al. 2010; D'Cruze et al. 2018a). The growing online component of trade in wildlife products is also a particular conservation concern related to illegal wildlife trade in India. The '*hatha jodi*' trade, for example, originating from India, targets CITES Appendix I monitor lizards (including the Bengal monitor and yellow monitor (*Varanus flavescens*)) for their hemipenes that are dried and falsely sold online as rare and 'sacred' Himalayan plant roots purported to have spiritual properties (D'Cruze et al. 2018b). In our study, however, "economic opportunities" were not considered an important element of ritualistic hunts by any of the hunters surveyed, and it is important to note that, even for those hunters that do sell some of the meat or body parts obtained, this type of wildlife trade activity appears to function as a supplementary source of income. The majority of hunters surveyed stated that agriculture was their main source of income.

When hunters were questioned more broadly about their motivations for participating in these types of hunting festivals, our study uncovered a consistent positive sentiment toward ritualistic hunts, even among those who identified as non-hunters, despite the illegal status of the hunts (and the fact that many respondents were aware of their illegality). The majority of hunters ranked "engaging in a fun activity" and "maintaining a traditional practice" as important elements of ritualistic hunts, and some (n = 19) also ranked "social cohesion" as important. Personal enjoyment as a primary motivating factor (even above personal use for wild meat) may also help to partly explain recent observations

made by a number of conservation-focused NGOs, which have reported that the hunting festivals of south-western West Bengal have recently attracted an influx of hunters from surrounding areas including West Medinipur, Jhargram, Bankura, Murshidabad, Purulia and Jharkhand (HEAL 2020). These groups appear to involve individuals from "various walks of life" beyond those involved in local agriculture including students, teachers, shopkeepers, factory workers, and even government employees (Kazmi 2021).

Animal welfare concerns

Our research also draws attention to the animal welfare concerns associated with ritualistic hunts. A growing body of research continues to demonstrate the cognitive capacity of wild animals and their ability to experience a range of emotions and states including excitement, fear, frustration, and pain (Lambert et al. 2019). In this context, ritualistic hunts raise significant concerns not only due to the relatively high number of individual animals involved, but also due to the intensity and duration of suffering that they can experience throughout the different stages of the trade chain including capture, transport, and slaughter (Baker et al. 2013). For example, our study revealed that hunters reported employing 13 different primarily traditional killing methods during capture, with bows, catapults, and spears being the most commonly used. These findings align with similar studies; for instance, Aiyadurai et al. (2010) also documented the use of various indigenous capture methods like stone-fall, trigger-and-release, canopy, spring-pole, gum, metal noose, hanging stone, pitfall, box, log-fall, and rodent traps. Additionally, Dutta and Mondal (2020) reported the use of nylon nets for catching wild hare, iron wire for rats, sticky gum from various plants for capturing water birds and other birds near water bodies, and lancets with pointed tips for killing larger mammals. All these methods can lead to a slow and painful death, characterized by considerable pain and suffering. Moreover, in describing "memorable experiences" associated with taking part in ritualistic hunting, when hunters did refer to the animals directly, they talked about "chasing" and being "chased", it being "funny" when two hunters tried to kill the same animals, and their friends laughing as they tried or failed to hunt or kill an animal. In some cases, hunters referred to hunted animals (boar or in one case, a tiger) biting or attacking the hunters (n = 4), hurting the hunters (n = 3), or hunters being killed by the animals (n = 3). Few hunters (n = 24) provided answers to these questions, so it is not possible to determine to what extent they are representative of all ritualistic hunts and all hunters but, in addition to being potentially dangerous to the hunters, the scenarios described suggest an experience that is highly stressful for the animals involved.

Although the wild animals are often slaughtered, skinned, and cooked at the hunting site, they may also be taken away for slaughter elsewhere (HEAL 2020). For example, hunters have been observed slaughtering, skinning, and cooking wild animals openly on the railway platforms (HEAL 2020). In these cases, the captured wildlife remains alive during transport that can involve physical restraint before their meat, skins and other body parts are consumed or prepared for onward sale. This raises particular animal welfare concerns given that some researchers have reported how villagers in other locations have described that they travel longer distances (>5 km) to hunt than they have done a decade ago (presumably due to wildlife population declines around villages) (Aiyadurai

et al. 2010). These animal welfare concerns also pose a risk to public health, particularly in relation to the spillover of zoonotic diseases in scenarios where animals have endured debilitating conditions that compromise their immune systems and that promote disease transmission (Shivaprakash et al. 2021).

Conservation concerns

Our study reiterates potential conservation concerns associated with ritualistic hunting in India (e.g., Aiyadurai et al. 2010). According to the IUCN Red List, a considerable proportion of the wild animals that are targeted by hunters in the districts of Jhargram and West Medinipur, are already considered as threatened (7.5%) (Suppl. material 2). In particular, some common names provided by respondents as either most desirable or most profitable species that could be captured include three species which are currently classified as Critically Endangered (the elongated tortoise, long billed vulture, and slender billed vulture [see footnote 2]), and four species (the common pochard, swamp francolin, pale capped pigeon, and sambar) that are classified as Vulnerable (Suppl. material 2). For these species, already considered at risk of extinction, even relatively low-level trade (as reported for long billed vulture) can have highly detrimental impacts on their conservation status. However, the risk of local extirpation to species that are currently considered as non-threatened should not be ignored especially given that these types of hunting festivals often take place in remote regions where law enforcement is challenging to implement, and where wildlife populations may already be in decline - a perception reported by 51 (68%) of the hunters that participated in our study.

Specifically, 28 of the species inferred on the basis of local and common names given by hunters as most desirable or profitable species are not currently listed on the IUCN Red List as threatened but have wild populations that are considered to be either in decline, not assessed or unknown (Suppl. material 2). This includes the Bengal monitor which is currently considered as Near Threatened but is listed on CITES Appendix I, and several mammal species (including the jungle cat, wild boar and Indian hare) which are currently classified as Least Concern but which have been identified to be at risk of local extirpations due in part to unsustainable hunting for their body parts for personal use and commercial sale (IUCN 2023). All of these species were named specifically by hunters. Hunters also referred to 23 species that have greatly increased in rarity from the hunters' perspective, such as the yellow-footed green pigeon, western koel (*Eudynamys scolopaceus*), Indian peafowl (*Pavo cristatus*), golden jackal, and Indian wolf (Suppl. material 2). Some species (such as the wild boar, Bengal monitor, red junglefowl, Indian hare, and Russell's viper) may also be of particular local conservation concern despite their current non-threatened status as they were found to be particularly expensive and among the species perceived to have increased most in rarity in recent years (Suppl. material 2). Relatedly, it is also worth highlighting that IUCN Red List assessments for a number of the species identified in this study, such as the small Indian mongoose, chital (*Axis axis*), sambar, Asian chameleon and jungle cat, were undertaken more than 10 years ago and therefore may not fully reflect the conservation status of these species.

Ritualistic hunting in contemporary West Bengal appears to have departed significantly from its original cultural components as described by Ghai (2017) and Sarkar and Modak (2022). Sarkar and Modak (2022), for example, describe

how the main purpose of the festival is not killing animals, and suggest the presence of cultural components that regulate offtake, such as that pregnant and juvenile animals are not targeted. In contrast, instances of pregnant females, young offspring, and entire groups of animals being killed have been documented in recent years (HEAL 2020; Fig. 7), further indicating that these hunting festivals are associated with indiscriminate killing of wildlife which raises additional conservation concerns. Unsustainable hunting and defaunation, for example, compromises ecosystem resilience and can lead to reduced forest regeneration with wider impacts on both the conservation and the carbon storage capacity of forests (Gardner et al. 2019).

Study limitations

Wildlife trade surveys that touch upon illegal and/or unsustainable activities should be interpreted with care; not least because markets are complex systems that can vary over time (due to a variety of different factors) and those involved in the trade chains may distrust surveyors or have poor memory recall (D'Cruze et al. 2018a; Mayor et al. 2019; Newton et al. 2008). However, that 112 individuals were willing to talk to us, and that 99 of them openly admitted to their own involvement with illegal hunting, suggests that they were being truthful. Moreover, while there is a risk that our data may underestimate or overestimate the impact on wildlife in Jhargram, West Medinipur, and surrounding areas of West Bengal, it is important to clarify that our aim was not to assess the full extent of impact on wild populations or individual animal welfare.

Rather, our intention was to gain new insights into the diversity of wildlife being targeted (by hunters), to better understand what they might be used for (both by hunters personally and any subsequent consumers following onward sale), and to identify those wildlife species that might potentially be at risk. Likewise, a full inventory of wildlife being hunted in these two districts, including identifying species that are most targeted and the frequency of trade, was beyond the scope of this study. Specifically, we acknowledge that our use of local names to infer the species hunted and sold cannot be considered a complete taxonomic account, and that in some cases hunters may be referring to only one particular species that is not threatened by extinction or vice versa. Yet, despite the limitations of a "snapshot" survey-based approach, we believe that our findings represent valuable information that can be used to help provide information for future efforts to protect wildlife in West Bengal.

Recommendations

Our study highlights the indiscriminate killing of a wide variety of species during illegal ritualistic hunts in West Bengal including potentially at least 25 that are listed on Schedule I of the Wildlife Protection Act. While recognizing that ritualistic hunting is a complex issue involving various stakeholders with diverse perspectives and goals (Sanctuary Nature Foundation 2021), our research provides valuable information that can inform future initiatives. Our recommendations are not exhaustive but include the following five key points: 1) Firstly, considering the potential for detrimental impacts on wildlife populations, it is imperative that wildlife crime be taken seriously, and this includes

increasing the risk of apprehension, prosecution, and punishment (Gomez et al. 2023); 2) While the decision by the Calcutta High Court to equate indiscriminate wildlife hunting with murder under Section 302 of the Indian Penal Code indicates that there is strong judicial will to end ritualistic hunts in West Bengal, effectively addressing the complex issue of illegal wildlife hunting and subsequent trade requires a multi-faceted strategy that extends beyond law enforcement alone. In particular, initiatives aimed at instigating positive changes in human behaviour, based on research into impactful messaging, including the animal welfare, conservation, public health, and legal risks associated with engagement in illegal wildlife trade activities, are also increasingly recognised as an essential component of an effective approach (Sanctuary Nature Foundation 2021; Moorhouse et al. 2024). Consequently, the Humane Committees proposed by the Calcutta High Court are likely to be more effective if they incorporate these types of human behaviour change initiatives into their future plans for delivering positive change for both wildlife and people; 3) Campaigns aimed at raising awareness locally about regulations governing the hunting of species and the negative impacts of utilisation and illegal trade in wildlife on local populations, conservation, animal welfare and public health may also be beneficial to motivate communities to stand against wildlife exploitation, particularly among younger generations (Bhattacharya et al. 2019); 4) In addition, further exploration of legal non-consumptive alternatives could also assist efforts to effectively curb these types of illegal hunting festivals in West Bengal, especially given that the majority of respondents in our survey expressed a willingness to embrace them if they were made available. In particular, to address the void left by the enjoyment derived from any ritualistic hunts, the development and promotion of "wildlife-friendly" tourism (as previously suggested by Dutta and Mondal 2020) such as bird watching could emerge as an important and viable solution (e.g., the "Catapults to Cameras" programme that promotes photography of wildlife instead of killing (Marik 2024)), or outdoor "festival" type non-consumptive but wildlife-focused activities that still bring elements of fun and celebration that are reportedly key motivations for people taking part in ritualistic hunting. Beyond personal enjoyment, these types of "wildlife friendly" initiatives could also help to reduce engagement in the hunting of wildlife for personal use or as a supplementary form of financial income by fostering a holistic, ethical, and sustainable approach to wildlife protection in the region. This type of community behaviour change is not unprecedented: the Angami tribe in Khonoma village in Nagaland, NE India stopped hunting in the 1990s driven by village leaders responding to the killing of endangered Blyth's tragopans (*Tragopan blythii*) and, although negotiations with villagers were reportedly on-going for several years, created the Khonoma Nature Conservation and Tragopan Sanctuary (KNCTS) in 1998 in the first community-led conservation project in India (https://vikalpsangam.org/wp-content/uploads/migrate/Stories_PDFs/community_conservation_at_a_crossroads_in_khonoma.pdf). There are also more examples of (self-imposed) hunting bans imposed by villages through the traditional village council in community lands in Arunachal Pradesh (Datta and Naniwadekar 2019). Many younger people are now engaged with 'hunting' and observing wildlife (including birds, butterflies and moths) with cameras and binoculars and taking pride in their natural heritage. Likewise, in the context of ritualistic hunting for wildlife derivatives as traditional medicine and

belief-based use (both for personal use and commercial profit), mechanisms to promote the substitution of sustainably sourced plant-based medicinal materials for wildlife-origin materials could also prove useful. Several studies have recently noted that this type of initiative could be effective in countries where most traditional medicine remedies are predominantly of botanical origin, and animal-origin remedies are known to have herbal alternatives.

Additional information

Conflict of interest

This study was funded by an animal welfare organisation; four of the authors are employed by the same organisation (NDC holds the position of Head of Research) and LAH received funding from the same organisation. HEAL is a wildlife conservation organisation. The results presented in this paper were in no way influenced by either the funding source, or our own personal views on animal welfare or conservation.

Ethical statement

Ethical approval was obtained via Manchester Metropolitan University on 06/09/2022, EthOS Reference Number: 43711.

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Author contributions

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Data availability

All of the data that support the findings of this study are available in the main text or Supplementary Information.

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Supplementary material 1

Questionnaire survey questions

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Data type: docx

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Supplementary material 2

Species list

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Data type: xlsx

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Supplementary material 3

Price data

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